REMARKS

INTRODUCTION:

In accordance with the foregoing, claims 2, 13, 24 and 26 have been amended. No new matter is being presented, and approval and entry are respectfully requested.

Claims 2-3, 7, 13-14, 17-18, 21-22, and 24-26 are under consideration. Claims 1, 4-6, 8, 9, 11, 12, 15, 16, 19 and 20 are withdrawn from consideration. Reconsideration is respectfully requested.

REJECTION UNDER 35 U.S.C. §112:

In the Office Action, at page s 2-3, numbered paragraph 3, claims 2, 3, 7, 21, and 22 were rejected under 35 U.S.C. §112, first paragraph, for the reasons set forth therein. This rejection is traversed and reconsideration is requested.

The Examiner submits that claim 2 requires "performing plasma etching at a variable speed," and that the specification fails to disclose this feature. It is respectfully submitted that on page 17, beginning at line 32, the specification recites: "The controller 29 may variably adjust the moving speed of the coil antenna 23. This can reduce the depositing rates of etching products having different properties." It is respectfully submitted that this recitation discloses the feature of performing plasma etching at a variable speed.

With respect to claim 3, it is respectfully submitted that "The plasma etching apparatus according to claim 2, wherein the high frequency coil antenna includes a plurality of winding portions, and the portion that produces a relatively large capacitive coupling with the reaction tube includes a sloped segment continuously formed between two of the plurality of winding portions in series, and the sloped segment is located closer to the reaction tube than the plurality of winding portions" is supported by line 12 of page 8 through line 13 of page 9:

> [0040] As illustrated in FIGS. 2a and 2b, the coil antenna 23 has **an upper and a lower winding 31, 32**, which are parallel with each other and which are separated by a predetermined spacing, and **an intermediate segment or sloped segment 33, which is continuous with the upper winding 31 and the lower winding 32** and which connects the end of the upper winding 31 to the end of the lower winding 32. The upper

winding 31 is connected to the power supply terminal 23a, while the lower winding 32 is connected to the ground terminal 23b.

[0041] The **upper and lower windings 31, 32 are formed to wrap approximately 3/4 of the way around the outer peripheral surface of the reaction tube 14.** The sloped segment 33 is formed to wrap approximately 1/4 of the way around the reaction tube 14. The **spacing between the sloped segment 33 and the outer peripheral surface of the reaction tube 14 is extremely small as compared with the spacing between the upper and lower windings 31, 32 and the outer peripheral surface of the reaction tube 14.**

[0042] Since the sloped segment 33 is in close proximity to the outer peripheral surface of the reaction tube 14, the sloped segment 33 has a reactive coupling larger than those of the upper and lower windings 31, 32. When the spacing between the coil antenna 23 and the reaction tube 14 is equal, the **reactive coupling becomes larger** at locations closer to the power supply terminal 23a and smaller at locations closer to the ground terminal 23b. In the first embodiment, since the sloped segment 33 is located in close proximity to the reaction tube 14, the sloped segment 33 has a capacitive coupling that is larger than those of the upper and lower windings 31, 32. Also, since the distance between the sloped segment 33 and the reaction tube 14 is substantially equal from the upper end to the lower end of the sloped segment 33, the capacitive coupling is substantially uniform over the entire length of the sloped segment 33.

(emphasis added)

With respect to claim 7, it is respectfully submitted that the terminology "The plasma etching apparatus according to claim 2, wherein the portion that produces a relatively large capacitive coupling with the reaction tube is located closer to the reaction tube than the remaining portion of the high frequency coil antenna" is supported by paragraphs 40-42 recited above.

With respect to claim 21, it is respectfully submitted that the terminology "The plasma etching apparatus according to claim 3, wherein the sloped segment is wound approximately

one-fourth of a way around the peripheral surface of the reaction tube" is supported by lines 21-29 of page 8 (paragraph 41) of the specification:

> [0041] The upper and lower windings 31, 32 are formed to wrap approximately 3/4 of the way around the outer peripheral surface of the reaction tube 14. **The sloped segment 33 is formed to wrap approximately 1/4 of the way around the reaction tube 14. The spacing between the sloped segment 33 and the outer peripheral surface of the reaction tube 14 is extremely small as compared with the spacing between the upper and lower windings 31, 32 and the outer peripheral surface of the reaction tube 14.**
>
> (emphasis added)

With respect to claim 22, it is respectfully submitted that the terminology "The plasma etching apparatus according to claim 21, wherein each of the windings is wound approximately three-fourths of a way around the peripheral surface of the reaction tube" is supported by lines 21-29 (paragraph 41) of page 8 of the specification:

> [0041] The **upper and lower windings 31, 32 are formed to wrap approximately 3/4 of the way around the outer peripheral surface of the reaction tube 14**. The sloped segment 33 is formed to wrap approximately 1/4 of the way around the reaction tube 14. The spacing between the sloped segment 33 and the outer peripheral surface of the reaction tube 14 is extremely small as compared with the spacing between the upper and lower windings 31, 32 and the outer peripheral surface of the reaction tube 14. (emphasis added)

Thus, claims 2, 3, 7, 21 and 22 are submitted to comply with the written description requirement, to be supported by the specification, and to be allowable under 35 U.S.C. §112, first paragraph.

REJECTION UNDER 35 U.S.C. §103:

The plasma etching apparatus of the claimed invention includes a high frequency coil antenna that, according to one embodiment, enables cleaning of a reaction chamber during

plasma processing. The coil antenna includes first and second winding segments and a third segment/an intermediate segment of claim 13/ a capacitive coupling segment of claim 24/a deformed segment of claim 26 (collectively referred to herein as "the additional segment") that is configured to produce a relatively large uniformly distributed capacitive coupling with a reaction tube. Said additional segment is continuously formed with the winding segments. Together, the winding segments successively extend in the coil antenna. Also, according to amended claim 2, said additional segment is closer to the outer circumference of the reaction tube than the other winding segments. This structure, according to one possible embodiment, shortens the total length of the coil antenna, simplifies the configuration of the coil antenna, and reduces the manufacturing cost of the plasma etching apparatus.

A. In the Office Action, at pages 3-5, numbered paragraph 5, claims 2, 3, and 7 were rejected under 35 U.S.C. §103(a) as being unpatentable over Tepman et al. (USPN 5,879,575; hereafter, Tepman) in view of Okumura et al. (USPN 5,888,413; hereafter, Okumura). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

It is respectfully submitted that Tepman neither discloses nor suggests the coil antenna of the claimed invention. Referring to FIGs. 5 and 6 of Tepman, which show an RF coil unit, the RF coil unit includes a plurality of coils 150 and a coil support 270 having support arms. In Tepman's apparatus, each coil 150 is a closed ring completely surrounding the reactor 240. This configuration increases the total length of the coils 150. Thus, Tepman neither teaches nor suggests the coil antenna of claim 2.

Okumura discloses a controller, but does not disclose the coil antenna of claim 2. Thus, it is respectfully submitted that since Tepman et al. and Okumura et al. do not teach or suggest, alone or in combination, amended claim 2, amended claim 2 is patentable over Tepman et al. (USPN 5,879,575) in view of Okumura et al. (USPN 5,888,413) under 35 U.S.C. §103(a). Since claims 3 and 7 depend from amended claim 2, claims 3 and 7 are submitted to be is patentable over Tepman et al. (USPN 5,879,575) in view of Okumura et al. (USPN 5,888,413) under 35 U.S.C. §103(a) for at least the reasons that amended claim 2 is submitted to be patentable over Tepman et al. (USPN 5,879,575) in view of Okumura et al. (USPN 5,888,413) under 35 U.S.C. §103(a).

B. In the Office Action, at pages 5-7, numbered paragraph 7, claims 13, 14, 18, 21 and 22 were rejected under 35 U.S.C. §103(a) as being unpatentable over Tepman et al. (USPN 5,879,575; hereafter, Tepman) in view of Takada et al. (5,525,379; hereafter. Takada). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

It is respectfully submitted that it is unreasonable to combine an apparatus of Takada and an apparatus of Tepman. One skilled in the art of the invention would recognize that these two apparatuses are designed for distinct purposes and operate according to distinct principles. For example:

Takada's antenna is configured to generate a helicon wave plasma. Tepman's antenna, in contrast, is not configured to generate a helicon wave plasma.

Tepman's antenna is configured to perform a cleaning operation during plasma processing. Takada's antenna, in contrast, is not configured to perform a cleaning operation during plasma processing.

Tepman's antenna is configured to be rotated for cleaning. Takada's antenna, in contrast, is not configured to be rotated. If Takada's antenna is rotated around the reactor chamber, the antenna would not generate helicon wave plasma having the desired power.

Takada does not teach arranging a segment of the antenna closer to the reaction tube for cleaning.

Thus, it is respectfully submitted that it does not make sense to combine the apparatus of Takada with the apparatus of Tepman because the two apparatuses are designed for distinct, different purposes. Therefore, it is respectfully submitted that claim 13, as amended, is patentable over Tepman et al. (USPN 5,879,575) in view of Takada et al. (5,525,379) under 35 U.S.C. §103(a).

Since claims 14, 18, 21 and 22 depend (directly or indirectly) from amended claim 13, respectively, claims 14, 18, 21 and 22 are submitted to be patentable over Tepman et al. (USPN 5,879,575) in view of Takada et al. (5,525,379) under 35 U.S.C. §103(a) for at least the reasons that amended claim 13 is submitted to be patentable over Tepman et al. (USPN 5,879,575) in view of Takada et al. (5,525,379) under 35 U.S.C. §103(a).

C. In the Office Action, at page 7, numbered paragraph 8, claim 17 was rejected under 35 U.S.C. §103(a) as being unpatentable over Tepman et al. (USPN 5,879,575; hereafter, Tepman) in view of Takada et al. (5,525,379; hereafter, Takada) as applied to claims 13, 14, 18, 21 and 22 above, and further in view of Okumura et al. (USPN 5,888,413; hereafter, Okumura). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

Claim 13 has been amended as noted above.

Okumura teaches a specialized controller that controls the stepping motor and the plasma processing based on control parameters stored in a memory 101. It is respectfully submitted that Okumura fails to teach a plasma etching apparatus comprising: an etching chamber to accommodate a workpiece; a reaction tube connected to the etching chamber, the reaction tube including an axis, an outer circumference, and being made of a dielectric material in the form of a cylinder; a coil antenna surrounding an outer wall of the reaction tube, the coil antenna including a first winding segment extending only partially around the outer circumference of the reaction tube at a first location along the axis of the reaction tube, a second winding segment extending only partially around the outer circumference of the reaction tube at a second location along the axis of the reaction tube, and an intermediate segment continuously formed with the first and second winding segments and successively extending between the first winding segment and the second winding segment in series; a plasma generating power supply to supply high frequency power to the coil antenna; and a drive mechanism to move at least one of the coil antenna and the reaction tube relative to the other to perform plasma etching on the workpiece, wherein the intermediate segment is located closer to the outer circumference of the reaction tube than the first winding segment and the second winding segment, as is recited in amended claim 13.

Okumura et al. discloses: "In each of the embodiments, the rotary shaft 4 of the stepping motor 3 is rotated to rotate the center end of each coil to change the pitch in the diameter direction of the coil" (col. 11, lines 54-57). Thus, Okumura et al. fails to teach moving the reaction tube, as is recited in amended claim 13 of the present invention.

It is respectfully submitted that Tepman et al. (USPN 5,879,575) (see above and response to previous office action), Takada et al. (5,525,379) (see above and response to

previous office action), and Okumura et al. (USPN 5,888,413), alone or in combination, do not teach such a drive mechanism.

Thus, amended claim 13 is submitted to be patentable over Tepman et al. (USPN 5,879,575) in view of Takada et al. (5,525,379) as applied to claims 13, 14, 18, 21 and 22 above, and further in view of Okumura et al. (USPN 5,888,413) under 35 U.S.C. §103(a). Since claim 17 depends from amended claim 13, claim 17 is submitted to be patentable over Tepman et al. (USPN 5,879,575) in view of Takada et al. (5,525,379) as applied to claims 13, 14, 18, 21 and 22 above, and further in view of Okumura et al. (USPN 5,888,413) under 35 U.S.C. §103(a) for at least the reasons that amended claim 13 is submitted to be patentable over Tepman et al. (USPN 5,879,575) in view of Takada et al. (5,525,379) as applied to claims 13, 14, 18, 21 and 22 above, and further in view of Okumura et al. (USPN 5,888,413) under 35 U.S.C. §103(a).

D. In the Office Action, at pages 7-8, numbered paragraph 9, claim 24 was rejected under 35 U.S.C. §103(a) as being unpatentable over Raaijmakers et al. (USPN 6,564,810; hereafter, Raaijmakers) in view of Tepman et al. (USPN 5,879,575; hereafter, Tepman). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

As noted by the Examiner, Raaijmakers et al. fails to teach a drive mechanism to move at least one of the antenna and the reaction tube to perform plasma etching. However, there is no teaching or suggestion of combining a drive mechanism of Tepman with the apparatus of Raaijmakers, as is submitted by the Examiner.

The coil of Raaijmakers is configured to be activated for cleaning after plasma processing (see claim 1). The activated coil 20 excites chemical gas to generate radicals of the chemical gas (see col. 5) after plasma processing. Thus, there is no need to rotate the coil 20, and there is no motivation to combine the drive mechanism of Tepman in the apparatus of the Raaijmakers to rotate the coil 20 of Raaijmakers.

Further, Raaijmakers does not teach the distance between the coil 20 and the reaction chamber. In particular, there is no suggestion of arranging a segment of the coil 20 closer to the reaction chamber. Therefore, the coil 20 cannot prevent etching products from attaching on the inner surface of the chamber during plasma processing operation even if the coil 20 is rotated.

In view of the foregoing, it is respectively submitted that claim 24, as amended, is patentable over Raaijmakers in view of Tepman under 35 U.S.C. §103(a)

E. In the Office Action, at page 9, numbered paragraph 10, claim 25 was rejected under 35 U.S.C. §103(a) as being unpatentable over Raaijmakers et al. (USPN 6,564,810) in view of Tepman et al. (USPN 5,879,575) as applied to claim 24 above, and further in view of Takada et al. (USPN 5,525,379). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

As noted in the response to D above, claim 24 is submitted to be patentable over Raaijmakers et al. (USPN 6,564,810) in view of Tepman et al. (USPN 5,879,575) under 35 U.S.C. §103(a). It is respectfully submitted that Takada et al. teaches a method for manufacturing an optical recording medium by using a helicon wave plasma CVD method to form an inorganic dielectric film on a substrate (see lines 7-12 of col. 3 of Takada), and fails to teach or suggest a drive mechanism to move the reaction tube relative to the antenna to perform plasma etching, as is recited by amended claim 24.

Thus, amended claim 24 is submitted to be patentable over Raaijmakers et al. (USPN 6,564,810) in view of Tepman et al. (USPN 5,879,575), and further in view of Takada et al. (USPN 5,525,379), under 35 U.S.C. §103(a). Since claim 25 depends from amended claim 24, claim 25 is submitted to be patentable over Raaijmakers et al. (USPN 6,564,810) in view of Tepman et al. (USPN 5,879,575), and further in view of Takada et al. (USPN 5,525,379), alone or in combination, under 35 U.S.C. §103(a) for at least the reasons that amended claim 24 is submitted to be patentable over Raaijmakers et al. (USPN 6,564,810) in view of Tepman et al. (USPN 5,879,575), and further in view of Takada et al. (USPN 5,525,379), alone or in combination, under 35 U.S.C. §103(a).

F. In the Office Action, at pages 9-10, numbered paragraph 11, claim 26 was rejected under 35 U.S.C. §103(a) as being unpatentable over Raaijmakers et al. (USPN 6,564,810) in view of Tepman et al. (USPN 5,879,575) as applied to claim 24 above, and further in view of Okumura et al. (USPN 5,888,413). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

Claim 26 has been amended in correspondence with amended claim 24, which is also in correspondence with the amendment of claim 13.

As noted above in C and E, neither Raaijmakers et al., nor Tepman et al., nor Okumura et al. teaches or suggests a drive mechanism to control a moving speed of the reaction tube, as is recited in amended claim 26. Thus, it is respectfully submitted that amended claim 26 is patentable over Raaijmakers et al. (USPN 6,564,810) in view of Tepman et al. (USPN 5,879,575), and further in view of Okumura et al. (USPN 5,888,413) under 35 U.S.C. §103(a) for at least the reasons that amended claim 24 is submitted to be patentable under 35 U.S.C. §103(a) over Raaijmakers et al. (USPN 6,564,810) in view of Tepman et al. (USPN 5,879,575), and further in view of Okumura et al. (USPN 5,888,413).

CONCLUSION:

In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot, and further, that all pending claims patentably distinguish over the prior art. Thus, there being no further outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited. At a minimum, this Amendment should be entered at least for purposes of Appeal as it either clarifies and/or narrows the issues for consideration by the Board.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited and possibly concluded by the Examiner contacting the undersigned attorney for a telephone interview to discuss any such remaining issues.

If there are any underpayments or overpayments of fees associated with the filing of this Amendment, please charge and/or credit the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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